

Claims

[c1] What I claim is:

1.In a process for the production of ethanol from vegetative matter wherein the vegetative matter is subjected to hydrolysis to produce sugars that are then fermented to form the ethanol, the improvement to which comprises subjecting some or all of the vegetative matter to cold solvent extraction prior to the hydrolysis.

[c2] 2.A process according to claim 1 wherein the cold solvent extraction comprises mixing propane with the feedstock at pressures less than about 200 psig and at temperatures less than about 140°F.

[c3] 3.A process according to claim 1 wherein the feedstock comprises cereal grains having hulls and wherein the hulls are removed from the feedstock and are the portion of the feedstock subjected to the cold solvent extraction to form an oil fraction.

[c4] 4.A process according to claim 3 wherein the oil fraction contains compounds having a pharmaceutical value.

[c5] 5.A process according to claim 3 wherein the oil fraction contains compounds having a nutrient value.

- [c6] 6.A process according to claim 3 wherein the de-hulled portion of the feedstock is subjected to the cold solvent extraction to form an oil fraction.
- [c7] 7.A process according to claim 1 wherein the feedstock is milled to a median particles size between one-quarter inch or less diameter, and the milled particles are subjected to a cold solvent extraction to form an oil soluble fraction separated from a starch-containing fraction.
- [c8] 8.A process according to claim 7 wherein the starch-containing fraction is subjected to hydrolysis to produce sugars that are then fermented to form the ethanol.
- [c9] 9.A process according to claim 7 wherein the milled particles are subjected to a separation process to form a starch-containing stream and an oil soluble stream, the starch-containing fraction then being subjected to hydrolysis to produce sugars that are then fermented to form the ethanol, and the oil-containing fraction then being subjected to a cold solvent extraction to form a second starch-containing stream and a second oil soluble stream.
- [c10] 10.A process according to claim 9 wherein the second starch-containing stream is then subjected to hydrolysis to produce sugars that are then fermented to form the

ethanol.

- [c11] 11.A process according to claim 9 wherein the second starch-containing stream is subjected to protein extraction conditions to form a protein-rich stream and a third starch-containing stream.
- [c12] 12.A process according to claim 11 wherein the third starch-containing stream is subjected to hydrolysis to produce sugars that are then fermented to form the ethanol.
- [c13] 13.In a process for the production of ethanol from whole corn kernels, the improvement to which comprises:
 - (a)milling the whole corn kernels to produce a milled corn portion whose individual corn particles have a median diameter of about one-quarter inch or less;
 - (b)separating the milled corn portion into a starch-rich stream and an oil-rich stream;
 - (c)extracting the oil-rich stream with a process solvent under extraction conditions to produce an oil soluble fraction and a starch-containing fraction;
 - (d)processing the starch-containing fraction and the starch-rich stream under process conditions to produce ethanol.
- [c14] 14.A process according to claim 13 wherein the process

solvent is propane.

- [c15] 15.A process according to claim 14 wherein the extraction conditions comprise extracting at a pressure less than about 200 psig and a temperature less than about 140°F.
- [c16] 16.A process according to claim 13 further comprising removing solvent from the starch-containing fraction prior to the processing to produce ethanol.
- [c17] 17.A process according to claim 13 further comprising processing the starch-containing fraction under process conditions to produce the ethanol, a fiber fraction, and a whole corn oil fraction.
- [c18] 18.A process according to claim 17 further comprising separating the ethanol, the fiber fraction and the whole corn oil fraction from one another.
- [c19] 19.A process according to claim 13 further comprising removing solvent from the oil soluble fraction.
- [c20] 20.In a process for the production of ethanol from whole corn kernels, the improvement to which comprises:
 - (a)extracting the whole corn kernels with a process solvent under extraction conditions to produce an oil soluble fraction and a first starch-containing fraction;

(b) milling the starch-containing fraction to produce a milled starch-containing fraction whose individual particles have a median diameter of about one-quarter inch or less;

(c) extracting the milled starch-containing fraction with a process solvent under extraction conditions to produce a second oil soluble fraction and a second starch-containing fraction; and

(d) processing the second starch-containing fraction under process conditions to produce ethanol.

- [c21] 21. A process according to claim 20 wherein the solvent is propane.
- [c22] 22. A process according to claim 21 wherein the extracting conditions comprise extracting at a pressure less than about 200 psig and a temperature less than about 140° F.
- [c23] 23. In a process for the production of ethanol from whole corn kernels, the improvement to which comprises:
- (a) milling the whole corn kernels to produce a milled corn portion whose individual corn particles have a median diameter of about one-quarter inch or less;
- (b) extracting the milled corn portion with propane at pressures under about 200 psig and temperatures at less than about 140° F to produce an oil soluble fraction and

a starch-containing fraction;

(c) separating the oil soluble fraction from the starch-containing fraction;

(e) processing the starch-containing fraction under process conditions to produce ethanol, a fiber-containing stream, and a whole corn oil stream;

(f) separating the ethanol, the fiber-containing stream, and the whole corn oil stream from one another.

- [c24] 24. A process according to claim 13 further comprising removing solvent from the starch-containing fraction prior to the processing to produce ethanol.
- [c25] 25. In a process for the production of ethanol from milled corn whose individual corn particles have a median diameter of about one-quarter inch or less, the improvement to which comprises:
- (a) extracting the corn particles with a process solvent under extraction conditions to produce an oil soluble fraction and a starch-containing fraction;
- (b) separating the oil soluble fraction from the starch-containing fraction;
- (c) processing the starch-containing fraction under process conditions to produce ethanol.
- [c26] 26. A process according to claim 25 wherein the process solvent is propane and the extraction conditions com-

prise extracting at a pressure less than about 200 psig and a temperature less than about 140°F.

- [c27] 27. In a process for the production of ethanol from milled corn whose individual corn particles have a median diameter of about one-quarter inch or less, the improvement to which comprises:
- (a) extracting the corn particles with propane at pressures of about 200 psig or less and at temperatures of 140°F or less conditions to produce an oil soluble fraction and a starch-containing fraction;
 - (b) separating the oil soluble fraction from the starch-containing fraction;
 - (c) processing the starch-containing fraction under process conditions to produce ethanol and a fiber-containing stream; and
 - (d) separating the ethanol from the fiber-containing stream.